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Original article

Does Iranian *Astragalus gossypinus* honey assist in healing caesarean wounds and scars?

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Abstract

Introduction: This study investigates the effect of Iranian *Astragalus gossypinus* honey on healing casesarean operation wounds and scars.
Methods: A prospective randomized controlled trial was conducted involving 130 women who had required a caesarean operation. They were randomized into three groups treated in honey, placebo and control groups. The REEDA scale on the 10th and Vancouver Scar Scale on the 40th post caesarean days were used to assess overall healing and scar healing, respectively.
Results: The mean healing and scar scores in honey, placebo and control groups on 10th and 40th postoperation days were not significantly different.
Conclusions: The findings do not support the use of Iranian *A. gossypinus* honey for accelerated wound healing nor does it have a prophylactic impact on scars.

Keywords: *Astragalus gossypinus* honey; Caesarean; Iran; Scar; Wound

Introduction

Caesarean section surgery as a method of birth has become common in Iran [1]. Severe anxiety results from; delay or failure in healing of the surgical wound as a common complication after caesarean section [2,3] the potential economic and emotional burden to the mother and society during a stressful postpartum period [4] and emotional detachment between mother and infant [5]. Research has shown that factors such as obesity [6], diabetes, hypertension, prolonged rupture of the foetal membrane, emergency caesarean, twin delivery [7], prolonged labour, caesarean section with long time [8], corticosteroid therapy [9], and immune suppression, anaemia, and poor homeostasis associated with haematoma formation result in increased postoperative complications. These complications include; infection, wound opening, necrotizing fasciitis, peritonitis, scar formation, can cause a longer hospital stay, and can necessitate individual interventions such as wound drainage, debridement, and repairing [4,5,10]. A scar is a mark remaining in the damaged skin following tissue improvement. Sometimes, it not only does not form a thin line but also grows in different directions and remains an anaemic area [11]. Hypertrophic scars lead to apparent and functional disfigurement and will create discomfort, physical stress, and dissatisfaction for patients [12]. Reducing oedema and exudates, producing granulation and epithelial tissue, and accelerating wound healing are known to lead to the reduction of hypertrophic scars [13].

Women who undergo caesarean section, in addition to the responsibilities of motherhood, will potentially endure pain, discomfort, and complications associated with caesarean scars that may lead to late initiation of the first breast-feeding and early weight loss in the newborns [14,15]. The existence of complications, lack of sufficient efficacy, and high cost of chemical treatments have given rise to the tendency for using traditional methods of healing and preventing scars.

Honey is a material of high nutritional value; it contains 20 kinds of sugar, eight types of vitamins, 11 types of minerals, 16 types of amino acids, and several enzymes [16], has antibacterial,

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anti-inflammatory, and angiogenic properties, and is shown to generate granulation tissue, facilitate epithelialization, prevent and reduce scars, and alleviate pain. These properties are due to its high osmolarity, and production of hydrogen peroxide and phytochemical substances in plants nectar [13,17,18]. In modern and traditional medicine, honey has been suggested as an effective factor in improving a variety of infectious wounds [19].

In the only randomized-controlled trial carried out using honey on wound infections after caesarean section and hysterectomy, healing bacterial infections, reduced antibiotics usage, reduced hospital stay, wound healing, and decreased scar formation have been reported [20]. Noting the existence of some research, but of not high quality, in this field [13,18–20], comparative studies utilizing different kinds of honey from different plant sources for choosing the greatest efficacy [21] and determining its impact on non-surgical wound infections appears necessary.

Clinical research on the effect of honey on wounds is also very limited in Iran; there are no pharmacological products from this natural product, and more importantly no reference has been made to the plant source of honey in such studies [22–24]. Review of laboratory studies conducted on different types of honey in Iran shows *Astragalus gossypinus* honey in terms of antibacterial effects is preferred to honey with other plant sources [25]. Considering the high rate of caesarean section in Iran and the problems associated with its scar, we decided to carry out a study on the effectiveness of honey produced from the *A. gossypinus* plant on prevention of scar development, reduction of pain, complications and satisfaction of women with caesarean scars free of complications and the effects of Caesarean wound healing time and the degree of scaring.

Methods

A cohort of women were identified who had undergone caesarean section with transverse lower uterine incision and Pfannenstiel incision on the skin by the same gynaecologist referring to Ayatollah Taleghani Hospital in Arak. In order to carry out a randomized-controlled clinical trial the honey and placebo groups, it was considered that at significance level 0.05 and a power of 0.90, a sample size of 40 in each group was necessary to detect a 20% difference in overall healing and scar healing between the honey and placebo groups [20]. Data collection was carried out following the approval of a proposal at Arak University of Medical Sciences Research Council (code: 310) and obtaining the confirmation for observing code of ethics from the ethics council (87-14 -43) and registration code in IRCT (Iran Registration Clinical Trial: 138802051845N1).

Mothers were visited 24 h after caesarean section in the women's surgery ward. Subjects, 17–35 years old, with gestational age between 37 and 42 complete weeks, maximum two previous births were studied. Women were excluded from the study if: they had a previous caesarean section or lower abdominal surgery in the area of caesarean incision, obstetric complications (eclampsia, preeclampsia, placenta previa, placental abruption, multiple pregnancy, chorioamnionitis, meconium-stained fluid, and polyhydramnios), obvious abnormalities in the physical examination of the neonate, neonatal admission in intensive care unit, excessive bleeding and the need for blood transfusion, caesarean section or hysterectomy with myomectomy, smoking or drug abuse, history of known diseases disrupting wound healing, or had a mental disorders over the past month. All subjects were under the prenatal care in health centres or private offices. In all cases, the skin repair method was plastic using nylon thread No. 20. All mothers were in the hospital for one night and were administered 4 g cefazolin (antibiotic) intravenous (in four divided doses of 1 g every 6 h). They received cephalexin capsules 500 mg four times daily for 7 days, had one injection of the opioids (50 mg Pethidine intramuscular) and injection of 25 mg promethazine after being transferred from the operating room. They took 250 mg mefenamic acid capsules every 8 h after oral intake in the first 24 h.

After obtaining written consent from the mothers, they were assigned to honey, placebo, and control groups through randomized complete block design. Randomly selected block size of 3 was used. The researchers and the patients were blind to the type of honey used. In conducting this study, natural honey obtained from the Astragalus herb in Ashtian region, Iran, was used. This substance contains sucrose 1.5%, fructose to glucose ratio of 1.2%, humidity 14%, positive distasis, and before hydrolysis sugar content of 67.2%. Although the exact preparation of the placebo due to the unique nature of honey, especially its unique aroma, is not possible, an attempt was made to produce a placebo with maximum compliance with the intended honey in terms of colour and consistency in Barij Essence Pharmaceutical Company. The substances used for the placebo were FD&C Yellow No. 6, distillated water (DW), polyvinylpyrrolidone (PVP), tri ethanol amine (TEA) and Carbapol 940. The honey and placebo were coded and packaged in 22 g tubes at Barij Essence Centre. Women's pain score at the site of sutures was measured 24 h post ceaserean through the use of a visual analogue scale (VAS) of pain as a valid and reliable tool [26]. The mothers were interviewed to obtain information about their demographic features, prenatal care, and nutritional and health recommendations during pregnancy. The cervical dilatation upon admission, amount of cervical dilation during caesarean section, number of vaginal examinations, quality of foetal membranes rupture, interval time (minutes) between the rupture and delivery, uterine contractions during delivery, blood type, and Rhesus factor of the parturient were determined. Also, haemoglobin (ml/dl) levels, duration of surgery, duration of oral non-feeding period for the mother, foetal presentation during the operation, type of anaesthesia during the surgery, vital signs immediately after surgery and temperature 24 h later, consistency of uterus, uterine bleeding, bleeding from the surgical site were recorded for the mothers. Moreover, the time of the first breast-feeding, neonatal gender, birth head circumference, and Apgar score one and five minutes after caesarean section were recorded for the neonates. Groups receiving the tube (honey or placebo) were instructed to remove the operation dressing at the site of surgery; clean

the stitches with cotton dipped in saline, and open the tube and place its content on the caesarean wound by pressing it in a way that the entire wound was covered. Mothers were asked to continue using the tubes twice a day until 16 consecutive days post caesarean [5].

The control group received neither local honey nor any of the local disinfectant materials (such as povidone iodine). Health and nutritional tips, such as bathing after hospital discharge and every other day afterwards, having sufficient mobility, avoiding lifting heavy things and any movement causing too much tension in the stitches, placing hands on the abdominal wall while coughing, avoiding flatulent foods, using laxative foods to prevent constipation, using milk, dairy products, meat, fruits, and vegetables on a daily basis, and using correct regular doses of honey, placebo, and antibiotics were instructed to all subjects. Patient diary forms for recording the daily use of antibiotics, tube contents, and observing health issues were administered to the mothers on the day of discharge and they were taught to fill them out with accuracy. In addition, the date of control visits was recorded in these forms. On the fifth day, patients were called by telephone to evaluate their care procedure, the method of applying the honey or placebo, and observing the recommendations. On day 10 postpartum, the site of surgery was examined to assess the wound healing process based on the REEDA scale including such variables as redness, oedema, ecchymosis, discharge, and approximation of the two edges of the wound [27] with each on a scale of 0–3. The sutures were then removed. Scores closer to zero indicated a greater improvement in wound healing. The length of caesarean section wound and length of wound remaining apart (the wound edges that have been separated) were also measured using a standard ruler. The mothers' waist circumference, weight, and height were assessed to determine their body mass index (BMI). In addition, evaluation of pain score at the site of stitches was done using the VAS. On day 16 post partum (end of treatment period), the mothers were called and asked to discontinue using honey and the placebo but continue using other health recommendations. On day 40 post caesarean section, the site of surgery was examined for evaluating wound healing based on REEDA scale, length of the surgical scar, length of the wound remaining separated and the caesarean scar based on Vancouver Scale considering vascularity, height, pliability, and pigmentation with scores from zero to three (zero indicating the absence of scar) [28]. The reliability of REEDA and vancouver scales was determined through the observers and assessors agreement (inter-rater reliability, $r = 0.80$, $P < 0.001$). Waist circumference, BMI, and pain score based on VAS scale were determined on day 40 postoperatively. The presence of possible side effects (as binary variables: yes or no), including pain, burning, itching, stiffness, moisture, dryness in wound area, or other side effects (as binary variables: yes or no) was evaluated by running interviews on days 5 (on the phone), 10, and 40 (in person) postoperatively.

Mothers' satisfaction in two domains: appearance of scars and the application of honey on the 5th day post partum (on the phone) and on the10th and 40th days after caesarean visits through interview was assessed through a likert scale (not at all = 1, very low = 2, low = 3, average = 4, high = 5, and very high = 6). Daily recording forms were assessed in each visit and the patients with no accurate records were excluded from the study.

In this study, data were analyzed by SPSS version 18. Mean and 2 standard deviation were used for describing the characteristics of the subjects. To evaluate the differences among honey, placebo, and control groups after running Kolmogorov–Smirnov (K–S) test for assessing the normal distribution of variables, ANOVA and Tukey test were applied to quantitative variables with normal distribution. Chi-square was used for assessing the qualitative variables and the bonferroni correction were determined on basis of three pair wise comparisons between honey, placebo and control groups. The value used for bonferroni correction was $P = 0.0167$.

Results

During the sampling period, from January 2008 to June 2010, 132 patients participated in this study (44 in the honey group, 42 in the placebo group, and 46 in the control group). Two subjects due to inaccurate application of honey or the placebo and 6 subjects due to absence on the 40th visit were excluded from the study. Eventually, 130 mothers on the 5th and 10th days postpartum (44 cases in the honey group, 40 in the placebo group, and 46 in the control group) and 124 subjects on day 40 postpartum (44 in the honey group, 40 in the placebo group, and 40 in the control group) were examined and assessed (Fig. 1). Means of age in the honey, placebo, and control groups were 27.48 ± 4.31, 27.38 ± 5.19, and 27.02 ± 4.95, respectively. Mean years of education were 11.39 ± 0.21, 11.95 ± 0.24 and 11.21 ± 0.27 in the honey, placebo, and control groups respectively.

The majority of the study women were pregnant with their second pregnancy (46.21%). Maternal blood type O was seen in 37.12% of the mothers and 99.24% of them were RH positive. In 75.76% of the subjects, foetal membranes were intact and uterine contractions did not exist during the operation.

Cephalic presentation was seen in 99.24% of the mothers and most of them (97.73%) received spinal anaesthesia. Also, the majority of the neonates (62.12%) were male. No statistical differences were observed in the three groups in terms of these variables. Cervical dilation upon admission, cervical dilatation inter operatively, number of vaginal examinations, interval time between membranes rupture and operation (in hours), operation time (in minutes), Apgar score in the 1st and 5th min postpartum, vital signs after surgery and temperature 24 h postoperatively, and duration of oral non-feeding period did not indicate any significant differences between the groups.

In all cases, neonates were fed immediately after mothers' transfer from operating room. In the recovery area, the uterus was contracted and postoperative bleeding was reported to be normal. Bleeding from the surgical site did not exist in any of the subjects. Table 1 presents the comparison between some of the measured variables in the three groups.

The comparison of pain score (VAS) 24 h, 10 and 40 days after caesarean in the three groups did not indicate any significant differences between the three groups (Table 2).

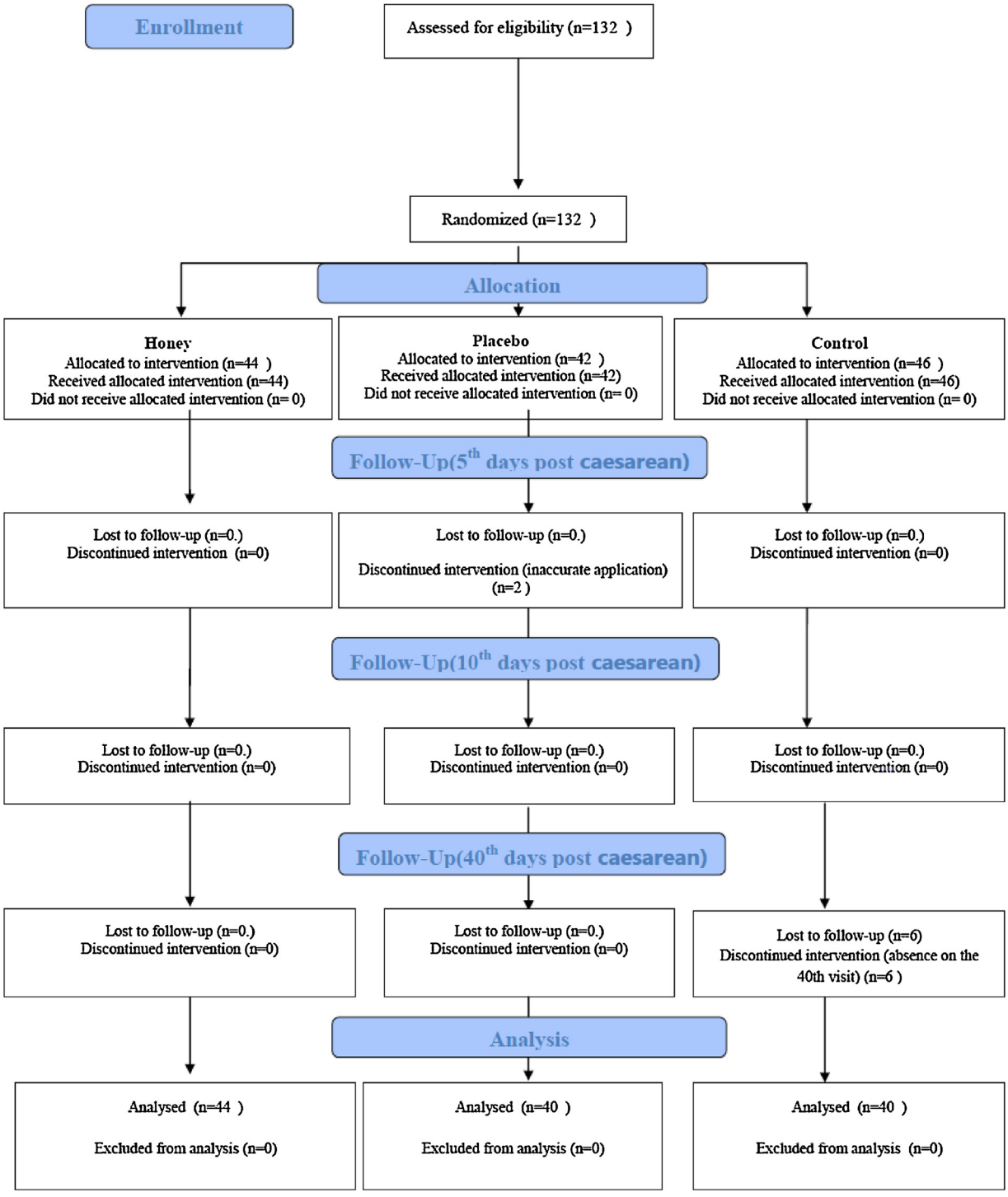

Fig. 1. The enrolment of participants into three groups of honey, placebo, and control.

Table 3 demonstrates caesarean wound healing scores and proportion of women with completely healed caesarean wounds and scars in Table 3 obtained on 10th and 40th days postpartum.

On the 5th day post partum, side effects such as itching, irritation, stiffness, and moisture did not differ in the three groups but feelings of pain ($P = 0.003$) and dryness ($P = 0.004$) were significantly different in the three groups. Chi-square test with bonferroni correction for feeling of pain identified about a difference between the honey and control ($P = 0.003$); however, there was not a significant difference between placebo and control nor between honey and placebo groups. Feeling of dryness between honey and control groups as well as between honey and placebo was not significantly different, but there was a significant difference between the placebo and control groups ($P = 0.003$). On the 10th day post partum, side effects such as itching, stiffness, moisture, irritation, and dryness did not differ significantly between the groups. Statistical tests did not reveal any significant differences between honey, placebo, and control groups in terms

Table 1
Comparison of mean (SD) of the measured variables in three groups of honey, placebo, and control.

	Honey mean (SD)	Placebo mean (SD)	Control mean (SD)	*P*
Age (years)	27.48 (4.31)	27.38 (5.19)	27.02 (4.95)	NS*
Education (years)	11.39 (0.21)	11.95 (0.24)	11.21 (0.27)	NS
Haemoglobin (g/dL)	13.31 (0.70)	13.28 (0.70)	13.30 (0.77)	NS
Cervical dilation upon admission (cm)	0.22 (0.51)	0.27 (0.50)	0.30 (0.59)	
Cervical dilatation inter operatively (cm)	0.75 (1.66)	1.10 (1.91)	1.22 (2.46)	NS
Number of vaginal examinations	1.7 0 (3.60)	2.55 (4.28)	2.41 (4.84)	NS
Interval time between membranes rupture and operation (h)	1.01 (2.58)	1.67 (3.18)	2.62 (6.11)	NS
Operation time (min)	30.34 (1.12)	35.16 (1.45)	33.77 (1.94)	NS
Apgar score in the 1st min postpartum	8.98 (0.15)	8.98 (015)	8.98 (0.61)	NS
Apgar score in the 5th min postpartum	9.98 (0.15)	9.98 (0.15)	9.91 (0.46)	NS
Duration of oral non-feeding period (h)	22.74 (5.86)	23.96 (4.60)	23.60 (4.85)	NS
Systolic blood pressure immediately after operation (mmHg)	110.00 (8.63)	110.24 (7.49)	111.33 (8.15)	NS
Temperature immediately after operation (Celsius)	37.17 (0.31)	37.05 (0.34)	37.08 (0.24)	NS
Temperature 24 h post caesarean (Celsius)	37.20 (0.26)	37.21 (0.27)	37.11 (0.22)	NS
Infant head circumference (cm)	36.22 (1.48)	36.02 (1.47)	35.97 (1.34)	NS
Birth weight (g)	3220.68 (406.89)	3247.86 (397.86)	3262.83 (353.28)	NS
BMI 10th day post caesarean (kg/m^2)	28.37 (3.34)	28.92 (4.00)	30.11 (3.53)	NS
BMI 40th day post caesarean (kg/m^2)	26.96 (3.06)	27.17 (3.26)	28.49 (3.56)	NS
Waist circumference 10th day post caesarean (cm)	96.92 (7.37)	96.28 (6.11)	98.25 (7.19)	NS
Waist circumference 40th day post caesarean (cm)	89.89 (6.67)	89.15 (7.22)	90.18 (7.98)	NS

	Honey *N* (%)	Placebo *N* (%)	Control *N* (%)	*P*
With second pregnancy	20 (45.45)	19 (45.24)	21 (45.65)	NS
Maternal blood type O	14 (31.82)	13 (30.95)	22 (47.83)	
RH positive	43 (97.73)	42 (100.00)	46 (100.00)	NS
Intact foetal membranes	35 (79.55)	30 (71.43)	35 (75.10)	NS
Without uterine contractions	35 (79.55)	30 (71.43)	35 (75.10)	NS
Cephalic presentation	44 (100.00)	41 (97.62)	46 (100.00)	NS
Spinal anaesthesia	42 (95.45))	42 (100.00)	45 (97.83)	NS
Neonatal sex (male)	24 (54.55)	24 (54.14)	34 (73.91)	NS

* NS: non significant.

of side effects such as feeling pain, itching, stiffness, moisture, irritation, and dryness on the 40th day post caesarean (Fig. 2).

Satisfaction in two domains of intervention and wounds appearance can be seen in Table 4.

Discussion

The findings of the study, as the first research conducted on non-infected caesarean wounds, did not indicate any significant effect of *A. gossypinus* honey on wound healing or the caesarean scar. Although the reported level of the statistical tests showed a greater wound healing impact for honey and the placebo than for the control group on the 40th day, honey was not preferred to a placebo and the observed differences do not seem significant in clinical practice. In fact, using honey did not affect the wound, scar, length, and length of remained separated wound of caesarean section. Application of honey or placebo on days 10 and 40 post partum did not have significant impacts on the level of pain. In examining the possible side effects of a caesarean wound 5 days after surgery, honey resulted in less pain than the control group although there were not any statistical preferences between honey and placebo as well as placebo and control groups. In addition, the placebo gave a less dry feeling than the control group; in fact, the dryness in the honey group was less than that in the placebo group and the control group. Although these differences were not significant, they seem to be related to the wound moisture absorbing effect of honey (due to high osmotic properties) when used early after the operation. Feelings of itching, stiffness, moisture, and irritation in these groups did not differ in reducing symptoms of pain, itching, stiffness, moisture, irritation, and dryness on the 10th and 40th days post caesarean, honey and placebo did not have signif-

Table 2
Comparison of mean of pain (SD) on visual analogue scale (VAS) on 1st, 10th, and 40th days post-partum in three groups of honey, placebo, and control.

	Honey mean (SD)	Placebo mean (SD)	Control mean (SD)	*P*
Pain 24 h post caesarean	5.50 (2.16)	4.86 (2.15)	5.57 (2.28)	0.26
Pain 10th day post caesarean (VAS)[a]	3.45 (1.95)	3.33 (2.10)	2.61 (1.61)	0.08
Pain 40th day post caesarean (VAS)[a]	0.11 (0.49)	0.08 (0.47)	0.08 (0.27)	0.89

[a] Visual Analogue Scale.

Table 3
Comparison of wound healing and caesarean scar means (SD) in honey, placebo, and control groups.

	Honey Mean (SD)	Placebo Mean (SD)	Control Mean (SD)	*P*
Length of caesarean section 10th day post caesarean (mm)	128.46 (11.22)	126.48 (10.64)	129.26 (7.52)	0.41
Length of caesarean section 40th day post caesarean (mm)	115.02 (9.78)	113.83 (10.65)	117.80 (8.28)	0.17
Length of remained separated wound of caesarean section 10th day post caesarean (mm)	6.47 (10.09)	5.12 (8.32)	9.01 (12.12)	0.21
Length of remained separated wound of caesarean section 40th day post caesarean (mm)	0.02 (0.15)	00.00	00.00	0.41
REEDA[a] scale 10th day post caesarean	2.80 (1.81)	2.58 (1.70)	3.48 (1.87)	0.05*
REEDA scale 40th day post caesarean	0.18 (0.58)	0.10 (0.30)	0.55 (0.64)	<0.001**
Vancouver[b] scale 40th day post caesarean	3.43 (1.50)	3.72 (1.32)	3.97 (0.97)	0.16

	Honey *N* (%)	Placebo *N* (%)	Control *N* (%)	*P*
REEDA scale 10th day post caesarean equal 0	5 (11.36)	3 (7.50)	2 (4.35)	0.40
REEDA scale 40th day post caesarean equal 0	39 (88.64)	36 (90.00)	21 (52.50)	<0.001**
Vancouver scale 40th day post caesarean equal 0	4 (9.10)	3 (7.50)	0 (00.00)	0.62

[a] Redness, oedema, ecchymosis, discharge, approximation.
[b] Vascularity, height, pliability and pigmentation.
* Tukey test results showed no significant differences on REEDA scale on the 10th post caesarean day between placebo and control ($P = 0.06$), honey, and control ($P = 0.17$) as well as honey and placebo groups ($P = 0.84$).
** Tukey test results on REEDA scale on the 40th day indicates the mean differences between honey and control groups, as well as between the placebo and control groups ($P = 0.005$ and $P = 0.001$, respectively) while the difference between honey and placebo groups was not significant ($P = 0.76$).

Table 4
Comparison of frequency of satisfaction levels (high and very high) in two domains of satisfaction with the intervention and satisfaction with wounds appearance in the three groups of honey, placebo, and control.

	Honey *N* (%)	Placebo *N* (%)	Control *N* (%)	*P*
Satisfaction of the intervention 5th day post caesarean (high and very high)	39 (88.64)	39 (97.5)		0.09
Satisfaction of the wound appearance 5th day post caesarean (high and very high)	38 (86.36)	38 (95.00)	30 (68.18)	<0.001*
Satisfaction of the intervention 10th day post caesarean (high and very high)	39 (88.64)	37 (92.5)		0.80
Satisfaction of the wound appearance 10th day post caesarean (high and very high)	39 (88.64)	38 (95.00)	34 (82.93)	0.21
Satisfaction of the intervention 40th day post caesarean (high and very high)	40 (90.91)	39 (97.5)		0.08
Satisfaction of the wound appearance 40th day post caesarean (high and very high)	39 (88.64)	40 (100.00)	35 (89.74)	0.21

* Comparison of groups using the Games–Howell test indicated a significant difference in satisfaction with the wounds appearance on 5th day postoperative between honey and placebo groups ($P = 0.014$) as well as placebo and control groups ($P < 0.001$). There were no significant differences between the honey and the control groups ($P = 0.063$).

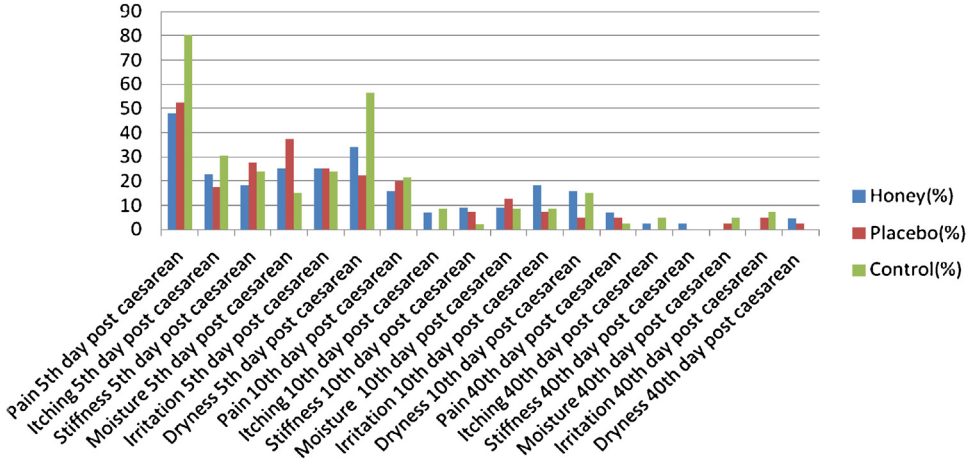

Fig. 2. Comparison of caesarean wound complications in the three groups of honey, placebo, and control on 5th, 10th, and 40th days post caesarean.

icant effects. Satisfaction with honey compared to a placebo on the 5th day post caesarean in both groups did not significantly differ, but more satisfaction with the appearance of the wound was observed in the placebo group than the honey and control groups, probably because mothers thought it created less dryness. Honey and the placebo were not preferred to each other and were comparable to placebo in terms of satisfaction with the intervention and wound appearance on days 10 and 40 post caesarean.

During the review of several studies conducted on the properties of honey as a wound healing accelerator, positive effects have been reported, but several limitations have been noted, including the inability in the blinding procedure due to its specific aroma [13]. A significant number of studies have been conducted in this regard but they have suffered from the small sample size, poor reporting quality [18], low validity scores and low quality of the majority of the studies [18,19]. On the other hand, most studies, using a randomized clinical trial, have explored the effect of this natural product on infected wounds and burns and few studies have dealt with abdominal surgery. Phuapradit and Saropala, during a non-randomized study, investigated the effect of topical honey in the treatment of abdominal wounds disruption and concluded that honey can be considered a cheap and effective treatment [3]; however, no statistical data was provided in this area. Al-Waili and Saloom [20] investigated the effects of topical honey on infected wounds caused by gram-positive and gram-negative bacteria created after caesarean section and hysterectomy in 50 patients. Overall, the results showed that the use of raw honey, not diluted, results in faster removal, reduction of the duration of antibiotics use and hospitalization, increased wound healing, prevention of disruption, lower need to stitches, and decreased scar production [20]. The findings of the present study might lead to this assumption that antiseptic properties of the honey used here have been stronger than epithelialization and granulation effects and even reduce the pain, or the disinfectant effects of honey are a prelude to subsequent effects. Since the wounds under study were non-infectious, significant impact on wound healing, scar prevention, and reduction were not reported.

Despite numerous experimental studies on the effects of honey on wound healing in Iran [16,25,29–31], clinical research, especially randomized clinical trials, is very limited. Sobhanian et al., during a clinical trial of a very small sample size (six people per group), recommended the use of honey because of its convenience, low price, and lack of complications although they did not find any significant differences between honey and routine treatment of diabetic foot ulcers [24]. Daghighbin et al. showed that topical application of honey is effective in wound healing episiotomy [22], whereas Nilforoush Zadeh et al. reported that acute cutaneous leishmaniasis lesions improve following treatment in combination with honey [23].

Of note is that the majority of the existing clinical research studies on honey have failed to identify the plant sources and there has been no emphasis on providing honey in a natural way. Specific plant sources related to honey production definitely may have specific properties [32], as an antibacterial and this may be up 100 times different depending on the plant source [25]. In the present study, we attempted to use a relatively sufficient number of samples, provide maximum blinding, control confounding variables to improve wound and scar of caesarean section, in order to obtain more reliable results. Although producing the perfect placebo for honey is not possible, maximum effort was made to match the colour and consistency of honey samples used through production of placebo and honey using a capped supply. In addition, wound and scar assessment was carried out by a person helping the researcher (not a researcher). Data analysis was conducted without the knowledge of the kind of the intervention to make the blinding be possible. The cleaned caesarean wound created the possibility of covering wounds completely with honey and provided the chance for this study to evaluate the wounds more accurately and use standardized tools to assess the exact process of wound healing and production of scar. However, the inability to accurately assess the wound through sampling due to the wounds being cleaned is one of the limitations of this study.

Conclusion

The findings of this study do not support accelerated wound healing and scar prophylactic impacts of Iranian *A. gossypinus* honey. Before recommending the use of honey, it is better that the effectiveness of its different species on healing various wounds is confirmed through studies of acceptable validity and quality.

Conflict of interest

There is no conflict of interest in this paper.

Acknowledgment

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